QML — The Next Big Thing

Karthiganesh Durai, Chief Quantum Architect

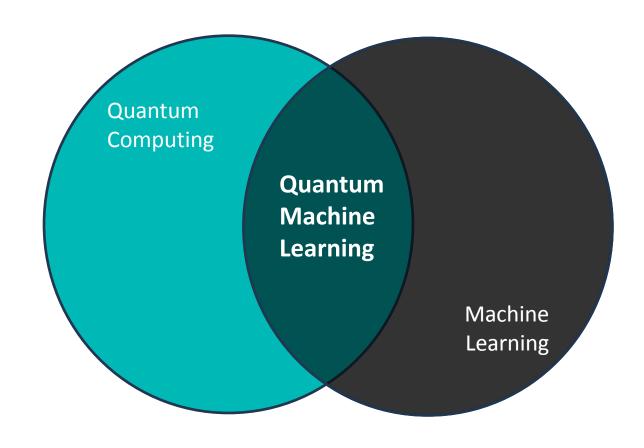
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Enabling Simulations with Quantum Paradigm



Scenario Machine Learning – The Next Big Thing

- Quantum machine learning is a research area that explores the interplay of ideas from quantum computing and machine learning.
- Machine learning revolves around algorithms, model complexity, and computational Complexity.
- Quantum Computing offers parallel processing capability which is essential to build efficient Machine Learning Solutions
- Quantum phenomena such as Superposition and Entanglement are helping the industry to build efficient Machine Learning algorithms



Applications of QML

QML is becoming a base building block for many scientific solutions

Classification

Nanoparticles

Molecular Modeling for drug discovery Prediction

Weather Forecasting

Geometric Difference Recommendation

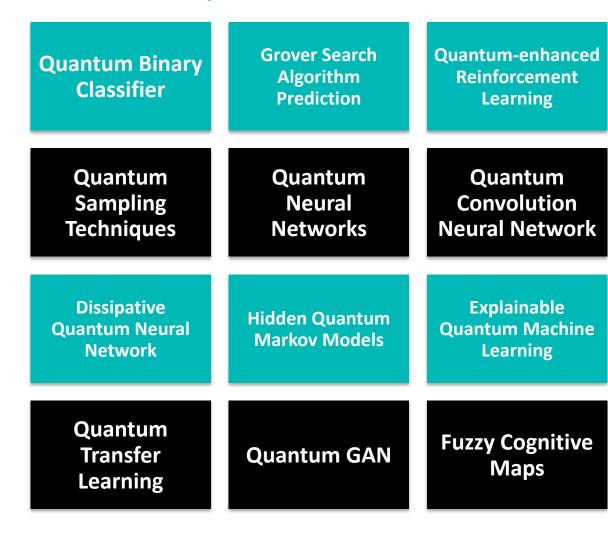
Space Exploration

Large Language Systems



QML Techniques

Quantum Algorithms solving machine learning tasks use various techniques



QML Ecosystem

Platforms and Approaches available for QML

IBM QISKit • https://qiskit.org/learn/course/machine-learning-course/ Xanadu Pennylane https://pennylane.ai/qml/ **CIRQ** • TensorFlowQuantum • https://www.tensorflow.org/quantum **D-Wave** • https://docs.dwavesys.com/docs/latest/handbook_problems.html#machine-learning **PyQuil** https://pyquil-docs.rigetti.com/en/stable/

QML Use Cases

Early attempts and Proof Of Concept for Quantum Machine Learning



1995-2013

1995 work on QML Kak-1995

2009 D-Wave: To detect cars in digital images using regularized boosting with a nonconvex objective function

2013 Google and NASA: Quantum Artificial

Intelligence Lab



2015-2018

Trained a probabilistic generative models with arbitrary pairwise connectivity for hand written image generation

Traffic Flow Optimization Using a Quantum Annealer



Since 2022

An Optimizing Method for Performance and Resource Utilization in Quantum Machine Learning Circuits

All-optical linear classifier

A perceptron model could learn the classification boundary

Powertrain matching and optimization of Dual motor driving system for Electric Vehicle based on Quantum Genetic Algorithms

2014

Experimental demonstration of a quantum speedup of the learning time of reinforcement learning

Quantum Neuron

TensorFlowQuantum release



2019-2021



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Contact Us

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